REMARKS

Claims 1-7 and 18-21 are pending in the current application; claims 8-17 have been withdrawn from further consideration. Claim 22 has been cancelled. Applicant cancels claims 8-17 without prejudice or disclaimer.

Applicant amends claims 1, 7, and 20 for the reasons discussed below. The amendments are shown in detail in the Appendix. Applicant also adds new claim 23 to provide alternative coverage for the Applicant's invention in the claims.

The Examiner rejects claim 20 under 35 U.S.C. §112, second paragraph, alleging that there is insufficient antecedent basis for the limitation "the heat sink" in the claim. Applicant amends claim 20 to recite "a heat sink" in order to overcome this rejection.

The Examiner also rejects claim 7 as only reciting limitations drawn to the intended use of the device. Applicant amends claim 7 to make grammatical changes in order to more clearly recite the structural limitation that was inherent in the original claim 7.

The Examiner rejects claims 1, 6, and 7 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent 5,608,749 to Kizuki. The Examiner also rejects claims 1, 5, and 7 under 35 § U.S.C. 102(e) as being anticipated by U.S. Patent 6,108,361 to Fujihara et al.

Applicant amends claim 1 as set forth in the Appendix to include a further limitation that the depth of the concave portion is at least equal to the thickness of the substrate. Fujihara does not disclose or suggest this limitation. In particular, Figure 6D of Fujihara shows that the groove 521 has a depth less than the thickness of the substrate 501. In addition, in Kizuki, the depth of region 8 of Figures 2(c) and 2(d) and region 9 of Figures 5-9 is not equal to or greater than the thickness of the substrate in which it is formed.

The Examiner rejects claims 2-4 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,281,524 to Yamamoto et al. in view of Fujihara. Applicant respectfully traverses this rejection. The combination of Yamamoto and Fujihara does not disclose or suggest all of the features of Applicant's invention as claimed in independent claim 2, and that furthermore it would not have been obvious to one of ordinary skill in the art at the time of the invention to combine these references.

One of the features of Applicant's invention as claimed in claim 2 is "a concave portion formed on at least a part of one surface of the semiconductor layer, said one surface being the surface further from the substrate". The Examiner alleges that Yamamoto teaches this feature in Figure 19. Applicant respectfully disagrees. Figure 18(b) shows the step of forming the groove 208 shown in Figure 19. Yamamoto does not disclose or suggest that groove 208 in Figure 18(b) is concave, nor does the Figure depict the groove 208 as concave (Yamamoto, column 11, lines 5-13). In fact, the drawing depicts groove 208 as being convex, not concave.

Fujihara does not supply this deficiency in Yamamoto as it does not disclose or suggest forming any grooves at the surface of the semiconductor layer furthest from the substrate. Therefore, Fujihara does not disclose or suggest this feature of claim 2 either.

Even if, assuming arguendo, the combination of Yamamoto and Fujihara did disclose all of the features of the invention as claimed in claim 2, there is nothing in the disclosures of either Yamamoto or Fujihara that would suggest to one of ordinary skill in the art to combine them. In fact, the references teach unrelated semiconductor laser devices. In particular, Yamamoto addresses grooves formed in the semiconductor layers, while Fujihara addresses grooves formed

in the substrate. Each reference is fully functional, and neither suggests any advantages to forming a groove in the layer shown in the other reference.

The Examiner over-generalizes the disclosure of Fujihara in alleging that it teaches "a metal having higher heat conductivity than the surrounding portion". Fujihara relates to heat dissipation with respect to the substrate through the use of a groove formed in that substrate. Nothing in the disclosure of Fujihara suggests that it is directed or applicable to anything more than this specific application.

The Examiner rejects claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Kizuki or Fujihara, alleging that the specific structural configuration of the concave portion is merely a design choice which does not significantly change the operation of the semiconductor device. Applicant respectfully disagrees. The structure recited in claim 4 is not merely a design choice.

The Federal Circuit has held that a claimed invention should rejected as a mere "design choice" when the applicant presents evidence of the technical advantages of the applicant's structure. In re Chu, 66 F.3d 292, 36 USPQ2d 1089 (Fed. Cir. 1995). Applicant's disclosure identifies the unexpected operational benefits obtained from a concave portion formed in a reverse mesa as recited in claim 4. In particular, the reverse mesa form of the concave portion allows the metal that fills the concave portion to be closer to the light emitting face of the laser element, thereby providing improved cooling characteristics (Applicant's Specification, page 9, lines 18-25). Therefore, because this structure confers unexpected advantages over other shapes, it is not merely a matter of design choice.

The Examiner rejects claims 18-19 under 35 U.S.C. § 103(a) as being unpatentable over Kawai. The Examiner acknowledges that the disclosure of Kawai does not disclose or suggest a GaN substrate as required by claim 18. The Examiner alleges that the use of GaN would have been obvious as a matter of design choice. Applicant respectfully disagrees.

The stated purpose of the devices and structure in Kawai is to provide improved heat dissipation in a semiconductor device when a semiconductor is formed on a sapphire substrate (Kawai, column 3, lines 26-34 and column 1, lines 47-55). Kawai notes that a sapphire substrate is advantageous despite its poor heat dissipation characteristics, because it is conducive to the growth of GaN semiconductors by chemical vapor deposition or molecular beam epitaxy (Kawai, column 1, lines 36-40). For this reason, Kawai implies that it is desirable to keep the sapphire substrate, rather than to replace it for a substrate with better thermal characteristics. In this regard, Kawai is not combinable with a reference that rejects the use of a sapphire substrate, because the use of a different substrate would render the cooling structure of Kawai irrelevant. It would not have been obvious to combine Kawai with a substrate made of a known material other than sapphire, because the stated purpose of Kawai, is to provide improved thermal characteristics in those semiconductor devices that are formed on a sapphire substrate. Claims 19-21 are allowable at least by virtue of their dependence on base claim 18.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned attorney at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 8-17 are cancelled without prejudice or disclaimer.

The claims are amended as follows:

1. (Amended) A semiconductor laser element comprising

a substrate,

a plurality of semiconductor layers formed on the substrate, and

a concave portion formed on one surface of the substrate, said one surface being opposite to the other surface having the semiconductor layers formed thereon, wherein

the concave portion is filled with a metal having a heat conductivity higher than the substrate, and wherein

the depth of the concave portion is at least equal to the thickness of the substrate.~~,~~

7. (Amended) The semiconductor laser element according to any of claims 1 to 3, wherein ~~the~~ said semiconductor laser element is ~~used as~~ a light source for exciting a solid laser.

20. (Amended) The semiconductor laser element according to claim 18 or 19, wherein the groove is filled with a metal having a heat conductivity higher than the GaN substrate,

wherein the surface having the groove is flattened, and wherein,

~~the~~ a heatsink is connected to the flattened surface.

New claim 23 is added.